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Foreign Agriculture

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PLOWING IN INDIA

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FRONT COVER

Plowing in India

A quick look at the cover shows no more than what has been seen in India for centuries—a farmer and his team of bullocks, but a more careful look will discover something new to the country—the all-metal plow, which in recent years has begun to increase the efficiency of India's farmers. (Photo courtesy of Barbara Ward.)

BACK COVER

Union of South Africa

The American Agricultural Attaché to the Union of South Africa has traveled from Gemsbock Park to the Little Karroo and from Lamberts Bay to Transvaal in the past 5 years collecting samples of grass, legume, and browse-plant seeds that he thought would be useful in southern United States. Several of these grasses are now growing on American farms and ranches and are highly satisfactory for forage and soil conservation.

NEWS NOTES

OFAR Coffee Specialists Return From Round-the-World Mission

Coffee hybrids resistant to a rust disease that is a serious threat to the coffee industry of the Western Hemisphere have been located in South India by two plant scientists of the United States Department of Agriculture — Dr. Frederick L. Wellman and Dr. William H. Cowgill — who recently returned from a 36,000-mile round-the-world search for coffee plants with such resistance.

The rust called Hemileia, although not present in the Western Hemisphere, is a constant threat to Latin America's billion-dollar coffee industry and could spread should it find its way into this Hemisphere. The rust virtually wiped out the Eastern Hemisphere's coffee industry in the late nineteenth and early twentieth centuries. The coffee species Arabica, whose berries are preferred in the United States for their quality and flavor, and which has been planted almost exclusively in the Western Hemisphere, is particularly susceptible to the disease.

Seeds of rust-resistant Arabica hybrids developed by India will be propagated in quarantine in the USDA Plant Introduction Garden at Glenn Dale, Md. Upon release, most of the seedlings will be sent to cooperating agricultural experiment stations in Brazil, Colombia, Costa Rica, and Puerto Rico for planting in test plots.

Foreign Agriculture magazine hopes soon to bring to its readers a full report on the trip and findings of Dr. Wellman and Dr. Cowgill.

Credit for photos is given as follows: p. 5, Joseph L. Dougherty; pp. 10-11, Earle K. Rambo; p. 12, Barbara Ward.

FOREIGN AGRICULTURE

ALICE FRAY NELSON, EDITOR

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African Grasses on United States Farms

by JOSEPH L. DOUGHERTY

"Settlers" from South Africa that have apparently come to stay in southern United States are dozens of grasses and legumes, which have been introduced on American farms and ranches during the past half century. Some are replacing native grasses; some are growing where nothing useful grew before. Thanks to these introduced plants, the soil on hundreds of thousands of acres of United States farm and ranch land has been conserved and improved.

During the past 5 years—while I have been in South Africa—approximately 700 samples of seed of species and strains of grasses, legumes, and browse plants have been forwarded to the United States from South Africa through the concerted efforts of the American Embassy and the South African Department of Agriculture for an exchange of plant materials and research information on an extensive scale.

Such an exchange of seeds and research information between the two countries is logical, for southwestern United States and South Africa are similar in so many respects that plants can adapt themselves quite readily to either area.

South Africa is one of the truly great grass countries of the world. An estimated 85 to 90 percent of its land is in grass, made up of hundreds of species and innumerable strains. This luxury in variety is, for the most part, the result of the variations in climate in South Africa, which are as great as in any other area of similar size in the world. During the summer months, October through April, rain falls over most of the vast inland plateau, which is 3,000 to 6,000 feet high and makes up about 80 percent of the country. During the rest of the year, there is almost no rain. Frosts are frequent in June, July, and August, and occasionally there is a light snow. Rainfall varies from 75 inches in the eastern part of the plateau to 2 or 3 inches in the extreme west.

I made a number of seed-collecting trips on this plateau; the last one—a 2,500-mile journey concentrated mostly in the Karroo area—was in June 1952. We were able to get 56 seed samples of karroo-bush and grass seed, among which were many strains of the range plants, *Pentzia* sp., *Tetragonia* sp., *Selago* sp., and such grasses as *Pennisetum* sp. and *Eragrostis* sp. The collection was larger than we had expected because the Karroo vegetation had suffered from a serious summer drought and from Karroo caterpillars.

There are many varieties of Karroo bushes to be found in the vast semiarid expanse of northern Cape Province and southern Orange Free State. Here, one can travel for hundreds of miles in any direction and see nothing but this low-growing browse plant. It is able to exist and provide palatable sustenance for South Africa's great sheep and wool industry on from 8 to 14 inches of rainfall per year.

The karroo bushes grow to a height varying from 3 or 4 inches to 2 feet or more depending on the species or combination of species and the soil and moisture conditions under which they grow. One of the characteristics of these remarkable plants is the uniformity in height in which they are found over vast areas. The plants are hardy, too, and drought resistant. Severe droughts can be expected in some parts of the Karroo nearly every year and in some years dry weather is prevalent over most of this country. It is during these dry years that sheep die by the hundreds of thousands and the karroo bushes are severely punished by the starving sheep. The vegetation manages to survive somehow, however, and grow again.

Fortunately, a trend has started among Karroo farmers to prevent overgrazing as much as possible during these trying periods—to rotate livestock from one pasture field to another or to refrain from grazing one pasture field, or camp, as it is called in South Africa, for as much as 12 months. These rest periods occur in rotation so that the whole farm will be benefited by this system over a period of 4 to 6 years. The principal advantage of such a rotational

Mr. Dougherty, Agricultural Attaché, American Embassy, Manila, Philippines, was Agricultural Attaché, Pretoria, South Africa, when this article was written.

grazing program is to permit seed to form, fall, and germinate, and the young plants to become well established before grazing is permitted again. These long rest periods are essential for the protection of the veld (range), where vegetation grows slowly because rainfall is low. Farms or ranches in the Karroo range from 10,000 to 30,000 acres.

On another collection trip, made late in May 1951, I went to the Gemsbock Park area adjacent to the southeastern border of South West Africa. The purpose of this field trip was to obtain grass and legume species from another semiarid area—this one with a rainfall of less than 10 inches. Unfortunately it was found that most of the species had dropped seed several weeks earlier but, even so, a number of additional strains were found of *Eragrostis,* sp., *Aristida* sp., *Pennisetum* sp., and *Panicum* sp., which made the 1,400-mile round trip worth while.

The 2-million-acre park, located between the Auob and Nossob Rivers, is so remote and so difficult to reach that it is not well known to most South Africans. Rain is so scanty in the park that the Nossob has not had water in it since 1934. Traveling is done along the dry river beds, which are rough and dusty. Along the dry bed of the Kuruman River, for example, dust clouds followed the car most of the way and dust particles were so fine that they made breathing difficult in the car, even when the windows were closed. The park contains hundreds of gemsbok, springbok, lions, and other game, which can readily be seen since the park is principally low-grass country. We even saw some camels along the way, remnants of the great herds used by the German mounted police in the days before World War I when South West Africa was a colony of Germany.

It was in October 1949 that six types of perennial veld grass *(Ehrharta calycina)* were found, along with some 70 other samples of grass, legume, and browse-plant seeds, on an 8-day 900-mile field trip from Cape Town to Van Rhynsdorp in Namaqualand and return. This veld grass has already found a significant place in the agriculture of central California, where it has spread rather widely and filled a necessary place for a perennial grass that permits a longer grazing season. This part of California is a winter rainfall area as is the strip between Cape Town and Van Rhynsdorp, where rainfall varies from 50 inches in the south to 3 inches or less around Van Rhynsdorp in the north. The altitude in this part of the Cape Province also varies—from sea level to 6,000 feet. Light snow is occasionally seen at relatively low altitudes and frequently on the mountain tops. Winter rains occur in June, July, and August and are responsible for this area's producing only slightly less than half of the Union's total wheat crop. Pasture lands are fairly extensive north of the wheat-growing sections. It is here, on the pasture lands, that wild flowers blanket the fields in the spring months of September and October.

On this field trip, we visited the Lamberts Bay Veld Reserve, where we found considerable seed, and the Rooibos *(Aspalathus contaminatus)* tea plantations around Clanwilliam, where we secured some grasses. Some of the most interesting and scenic rock formations to be found in southern Africa are in the vicinity of Clanwilliam. Near these rocks, we saw a group of baboons feeding, and on the top of the rocks were other baboons—the sentries. It is said here that if an enemy, such as a black-and-white spotted leopard, surprises and kills a member of the group and if no alarm had been given by the sentries, the whole group turns on the sentries and kills them.

One of the highlights of this field trip was a visit to the guano islands near Lamberts Bay, where fish-eating birds—malgas, sea gulls, sea eagles, and penguins—were so thick over an area of many acres that it was almost impossible to walk through them.

On this trip, too, we visited the Worcester Veld Reserve, near Worcester. The Botany Department of the Department of Agriculture has been running some observational tests here for a number of years on the grazing habits of sheep in connection with a number of the high-protein Karroo-type plants.

The next seed-collection trip, into Bechuanaland Protectorate in January 1949, was a combination trip in that the United States Bureau of Animal Industry had asked the Embassy to observe the progress of control measures for foot-and-mouth disease in Bechuanaland. On this trip, we collected 25 seed samples of various species and strains of grass including *Panicum maximum, Tricholaena* sp., *Eragrostis* sp., *Panicum coloratum, Sporobolus* sp., *Urochloa* sp., *Setaria* sp., *Sorghum* sp., and *Pennisetum ciliare.*

The seed was collected in the Malapye, Palapye, and Serowe districts, as well as along the patrol road at the border of the Tuli-block farms parallel to the Limpopo River. The journey of 125 miles from Martin's Drift took the party as far as the Shashi River, which forms a part of the border between Bechuanaland Protectorate and Southern Rhodesia. This is extremely wild country with lions, all kinds of buck, and some of the largest elephants in Africa. Trees were broken down everywhere as though a hurricane had just passed through. Members of the party said it was done by the elephants while feeding.

On my first seed collection trip in South Africa, late in May 1948, we covered 1,000 miles in 5 days, from Kimberley through Griqualand West, the Kalahari Desert, and Bushman land. Most of this area is in the northwestern part of the Cape Province on both sides of the Orange River through a rainfall area ranging from 5 to 15 inches a year. We found a number of such forage plants as the Tall Bushman *(Aristida ciliata),* the Short Bushman *(Aristida obtusa),* and Ga-grass *(Aristida fastigiata),* which have potential usefulness in the southwestern part of the United States in similar rainfall areas.

The *Arctotis staechadifolia* (Namaqualand daisy) was found near Kenhardt, where it was described by a farm owner as an excellent pasture plant for sheep. In this area we also found a wild pea of the

Collecting karroo-bush seed in South Africa for trial planting in the United States, where dozens of African grasses and legumes have already proved their worth.

Lebeckia species, a semidesert leguminous plant. Other species found included *Sporobolus, Eragrostis, Brachiaria, Pennisetum, Hyparrhenia, Rhynchelytrum, Eriocephalus, Danthonia, Pentzia, Tetragonia, Themeda,* and *Fingeruthia.*

Traveling through the semiarid sand dune country in the lower Kalahari Desert, we saw a number of scattered trees, and some of them were practically filled by a large nest used by the community birds. It was so quiet that the chirping of the birds could be heard for long distances.

An appraisal of the value of the grasses, legumes, and browse plants that have been introduced into the United States from South Africa indicates that some of them will prove of inestimable value for soil conservation and forage.

Four lovegrasses *(Eragrostis curvula, E. chloromelas, E. lehmanniana,* and *E. superba)* have adapted themselves quite well to southwestern conditions. Seeds from several of these species have been sent to the United States during past years, and it is likely that most of these grasses now growing in the United States can be attributed to them. New and improved strains of the later introductions may be receiving comparatively recent or initial multiplication and distribution among commercial seed firms and farmers. And certain of these new introductions may be replacing some of the older strains. Weeping lovegrass *(E. curvula)* is now in use on more than 50,000 acres in Oklahoma alone. One seed firm harvested 16,000 acres of the grass in 1951. Lehmann (*E. lehmanniana*) and Boer (*E. chloromelas*) lovegrass have been found to succeed in the extremely dry eroded conditions of our Southwestern States. Hundreds of species and varieties had previously been tried there without success. These lovegrasses alone are considered to be worth millions of dollars for revegetation and pasture. For example, Lehmann lovegrass has enabled the establishment of vegetative cover in Arizona where, because of lack of rainfall, nothing more palatable than mesquite and tumbleweed had grown. This grass has also proved to be one of the few that has established itself on burned-over areas in California. Wilman lovegrass *(E. superba)* has also found a valuable place in Arizona.

A later introduction known as Buffel grass *(Pennisetum ciliare)* is adapted to the deep sandy soils of south Texas, where a good soil holder and forage producer have been badly needed. Pongola grass *(Digitiara decumbens)* has adapted itself so well in Florida that more than 200,000 acres have been planted vegetatively. And two other species, *Tricholaena monachne* and *Brachiaria dictyoneura,* seem to be particularly suited to Florida.

A cooperative trial planting of guineagrass *(Panicum maximum)* looks promising on the King ranch in south Texas. Attention is also being given to the large collection of browse plants sent from South Africa for testing at grass nurseries in southern California. Two other grasses, *Digitaria eriantha* and *Panicum coloratum,* are being highly recommended for use in the Southwest as a result of their promising behaviour under nursery and district tests. A number of grasses are listed as promising but not yet sufficiently tested to be recommended. But perhaps these grasses, and certainly many others, will in time become established on American farms and ranches, multiplying the contribution that these South African "settlers" are making to United States agriculture.

Reading about... Foreign Agriculture

"The Sterling Area: An American Analysis," prepared by the Economic Cooperation Administration's Special Mission to the United Kingdom, brings together a great deal of basic economic information about the sterling area for the period from the end of 1945 to the middle of 1950. The content of the volume is limited to subject matter of special interest to people in the United States.

The 672-page volume is divided into three books. In the first book, *The Area and Its Members,* are discussions on the composite economy of the area, its basic economic relations with the United States and Canada, postwar problems and recovery progress, and methods of implementing postwar policies. Book Two deals in some detail with the economies of the member countries and Book Three, with the main commodities in sterling area trade.

The book is illustrated with more than 200 charts in color. It contains nearly 400 tables, a statistical appendix, and a subject index. The volume may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for $3.00.

Pork Production in the Tropics

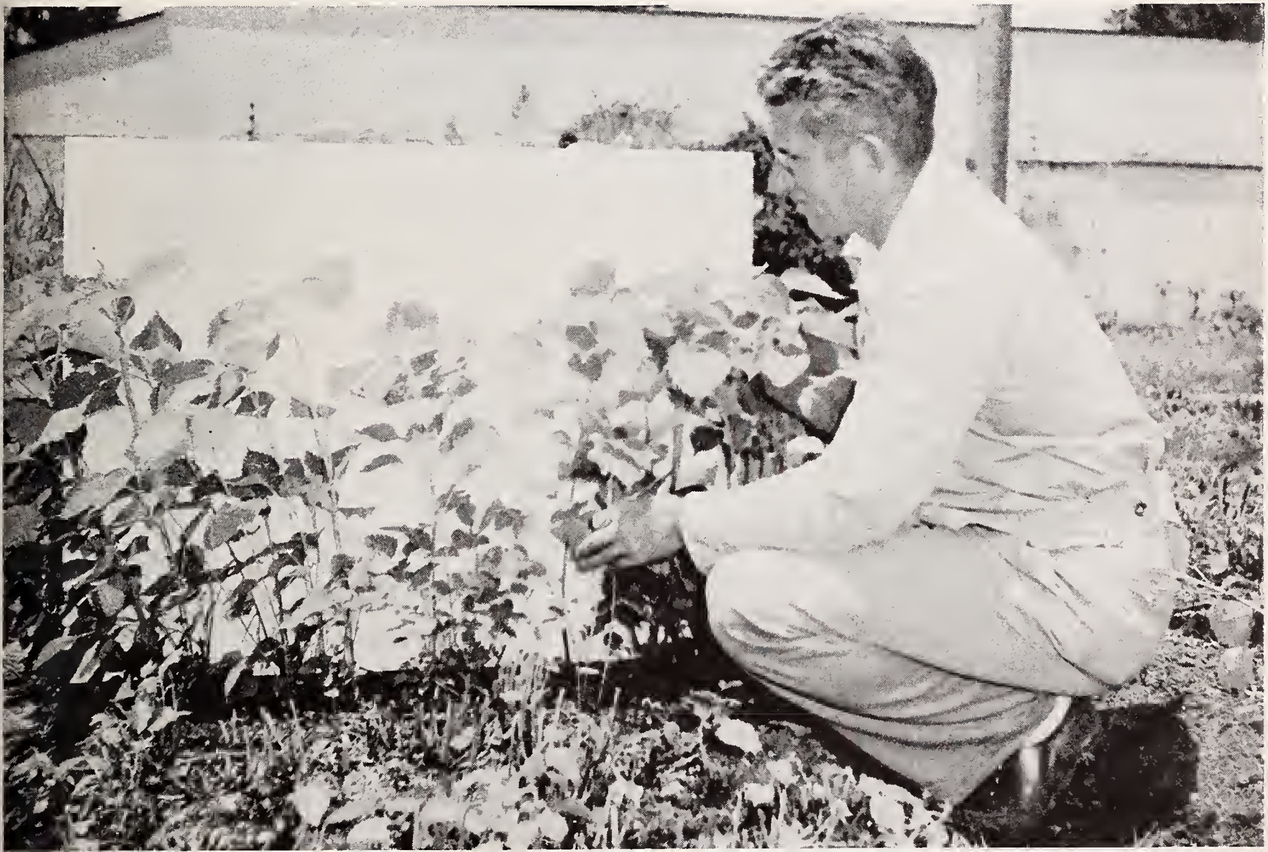
by KEITH HIMEBAUGH*

Agricultural research by United States technicians in Central America is opening up new possibilities for efficient, low-cost production of meat and lard that are of great importance to a large part of the world. Technicians at an agricultural station in Guatemala, for example, have demonstrated that pork can be produced with little or no grain by making a new use of the historic plant, ramie, that has served humanity for many centuries as a source of fiber. Ramie has been fed to livestock as a byproduct of fiber production, but now it has been found to have great value as a forage crop in immature stages before its fibers develop.

The promise of producing pork from forage is especially important in the Tropics, where millions of people live on diets that are deficient in animal proteins and fats. In most areas of the Tropics, corn and other grains are almost exclusively human foods, seldom plentiful enough or cheap enough to justify their use as feed. The knowledge that is being gained in Central America will be important, also, in the Southern States of the United States, where ramie will grow, and should be useful in reducing the cost of pork production there.

The men who are watching progress with ramie say that it has great promise as a feed for pigs up to the fattening stage in areas where the market demands fat hogs. They say, also, that in areas where grain is not available, hogs equal or superior to those now being marketed can be produced on ramie alone with only mineral supplements added.

The use of ramie as a forage crop for hogs came about as a result of a search made by United States Animal Nutrition Specialist Dr. Robert L. Squibb


Ramie, at this immature stage, has a high protein content, experimenters in Central America find.

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for a high-protein pasture for pigs being fattened on bananas. To the surprise of the research men, their pigs would eat nothing else as long as they could get enough ramie. Even those that had been accustomed to eating corn or bananas would leave these palatable feeds for the lush ramie forage. It is difficult to supplement the feed of pigs on adequate ramie pasture because they prefer ramie to corn or bananas. At the Chocola branch experiment station I saw workmen bringing in, to hogs on dry lots, bundles of cut ramie nearly 2 feet in length and with stems as big as my little finger. Young pigs and old hogs alike squealed in anticipation when they saw the ramie coming and proceeded to devour it completely. On ramie pasture, pigs will start eating at the top of the plant and work down. If the animals are not moved to a new lot when the top growth has been consumed, they will dig the roots and eat them too.

Ramie grows well in practically all Central American countries, anywhere from the seacoast up to altitudes of 5,000 feet and is said to do well over a wide range of the tropical and subtropical areas of the world. It is one of the oldest fiber crops known to man and produces, at maturity, one of the strongest fibers available.

Strangely, this fiber plant, in immature stages—at heights up to 20 inches—has only half the fiber of the forage crop, alfalfa. At the Chocola station, which lies in a high rainfall area, ramie will reach this height in 20 days. I saw 2-month-old ramie there, well above knee height, being cultivated with a tractor. The plants are started at wide intervals, and the vigorous roots, spreading out and sending up new shoots, soon fill the open spaces. Growing stalks, bent over and covered with soil, will take root and speed up the process. Cultivation to control grass and weeds helps ramie get a more rapid start.

Ramie is a perennial, not a legume, and under proper conditions will continue to supply good forage for a long period without replanting. It has numerous leaves, which are rounded in form and grow to 4 or 5 inches in diameter. Ramie is usually started by planting chopped pieces of roots; at Chocola, plantings also have been started with rooted cuttings, which reach maturity in 60 to 90 days from planting time. Immature ramie, on a dry-weight basis, has a protein content of 18 to 21 percent, which puts it in the class of high-protein animal feeds. As the young plant approaches maturity, the protein content goes down and fiber content increases rapidly. Now that the forage value of ramie has been proved, technicians in Guatemala are planting additional acreage so as to have enough experimental area to permit growing hogs to maturity on ramie.

Previous research on pork production by the United States technicians in Central America revealed that the feeding value of bananas, one of the oldest and most prevalent feeds for hogs in the Tropics, can be greatly improved by allowing the bananas to overrippen, then feeding them in a proper ratio to protein. It is believed that the slight fermentation that takes place, plus yeast growth on the skins, provides essential nutrients. This work, as well as the work on ramie, has made an important contribution to the knowledge of low-cost pork pro-

Pigs thrive on young ramie plants, which they seem to prefer to other feeds.

duction methods in the Tropics, and the fermentation procedures may increase the value of other feeds. At the Chocola station, a ration of overripe bananas, supplemented with sesame oil meal for protein, and with a mineral mixture of calcium, phosphorous, salt, and minor mineral elements, has made it possible to produce, at low cost, market-weight hogs in 6 to 7½ months. Low-grade or damaged bananas, which will not meet market specifications, are delivered at the experiment station for less than $1.00 for 500 pounds. This amount is approximately equal in feeding value to 100 pounds of corn, which, in Guatemala, may occasionally cost as much as $8.00 per 100 pounds.

The work with the traditional tropical feeds has great significance, not only in southern United States and Central America, but in other tropical and subtropical areas of the world as well. Producing pork from green plants that grow an inch a day—reducing the costs of pork production—could be one of the most important contributions yet made to the betterment of human diets in areas of the world where millions of people exist on rice and beans, are short on fats in the diet, and need meat to supply adequate supplemental amounts of the right kind of protein.

Farm Machinery in India

by EARLE K. RAMBO

India, it has often been said, is a land of contrasts and contradictions, and the farm machinery picture there is no exception to the general pattern. Bullock power is still the major supplement to human muscles in tilling and harvesting, and will no doubt continue to be on millions of tiny farms, where even the smallest tractor would be physically and economically impractical. Yet the Government of India operates a fleet of 240 of the largest crawler tractors made, with results that make social and economic sense. Such is the varied situation found by the American agricultural engineer who attempts to assist with mechanization problems in Indian agriculture.

Take the matter of harvesting grain, for example. In order to save every inch of straw for feed, the plants are cut close to the ground with hand sickles. The traditional method of threshing is to lay the bundled grain on the ground in a circle about 30 feet in diameter. Bullocks are then driven round and round the threshing ring for about 16 days, their hooves "walking out" the grain, which is later separated from the straw and chaff by winnowing.

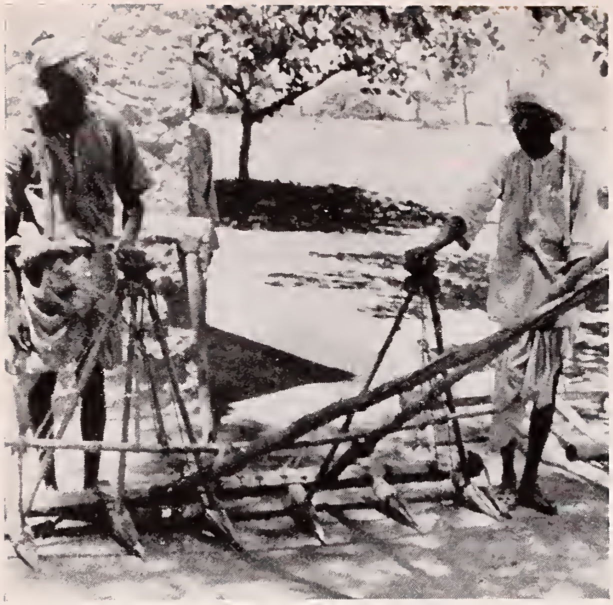
In a situation like this, one would think, the use of a Western-style thresher, or even the foot-powered thresher used in Japan and Formosa, would be a tremendous advance. But threshing machines are considered impractical in many areas because they leave the straw unbroken, a much less satisfactory feed than that which has been finely shredded under the feet of the patiently walking bullocks. An improved method that makes much more sense to the Indian villager is the so-called Indian thresher, a device resembling a disk harrow, which is drawn around the threshing ring by bullock power and does the threshing in about 2 days. At the same time the straw is crushed and chopped.

The point is that technological changes must be fitted into the social and economic pattern of the country. Methods and machines that seem eminently practical to Americans, for instance, are often, for one reason or another, completely unsatisfactory when transplanted, without adaptation, to foreign soil.

The problem of mechanizing Indian agriculture is being attacked on three broad fronts: (1) Relatively simple advances to increase production per man-hour and per acre on small farms operated by villagers, (2) heavy machinery for bringing new land into production, and (3) a program of training people in the operation and maintenance of farm machinery.

There are many ways in which improved tools, along with better seeds, fertilizers, and cultural methods, are working to reduce the back-breaking labor of farmers. Metal plows, adapted to Indian conditions and made in Indian shops, are gradually replacing the wooden plows that have scratched the soil for centuries. More efficient hoes and other hand tools make small but significant contributions.

Mr. Rambo, American Embassy, Beirut, Lebanon, was Consulting Engineer with the Point Four staff, New Delhi, India, when this article was written.



Six-row planter. Two persons walk behind the planter and drop seed through the spouts at regular intervals. Some Indian farmers are substituting grain drills for such planters, thereby saving labor and seed and increasing yields.

Field representative of a United States machinery company discusses tractor operation with employees of India's Central Tractor Organization. Several companies conduct courses in the use and maintenance of their equipment.

In seeding such crops as wheat and grain sorghum, the traditional country planter, consisting of a tube or set of tubes through which grain is dropped by hand, is being replaced in some areas with small grain drills made available by local cooperative societies. These machines reduce labor and, more importantly, increase yields and save seed by more efficient planting. The saving on seed alone is usually enough to pay the rental on the machine. Considerable trouble was experienced in adjusting drills because villagers could not read the English instructions. In one area the machines are being recalibrated in seers[1] per acre, with accompanying instructions in the local language, so even if the farmer is illiterate, he can always find someone in the village who can read and assist him.

Mowing machines were tried in some villages and rejected because raising the tongue to the height required for hitching them to bullocks threw the machines out of level, increasing the draft and reducing the efficiency of the mowing. This problem was solved by the simple expedient of placing a triangular block between the tongue and the frame to raise it to the required height, restoring mowing efficiency and reducing draft to the point where windrow attachments could be added.

Mechanization of village agriculture is but one phase of the widespread village improvement program being vigorously promoted by the Central and State Governments of India, with assistance from the Ford Foundation and United States Point Four technicians. Increasing production in the villages does not necessarily add materially to the supply of grain and other foodstuffs moving into market, but it does serve to raise the standards of living of the villagers and release to deficit food areas any imports that the village might otherwise need.

To say that tractors are impractical on many village farms, fragmented into a patchwork of tiny plots by inheritance and subdivision, is not to say that the tractor has no place in Indian agriculture. On the contrary, tractors and other power machines of all sizes and descriptions are being used in ever-increasing numbers. It is estimated that during the past two years[2] the number of tractors in India has doubled to approximately 20,000 machines, a majority of which are privately owned. Many individual operators of moderate-sized farms are purchasing small- and medium-sized tractors for their own use and custom work for their neighbors. Despite repair and maintenance problems and other "growing pains," they are proving their worth.

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[1] A seer is approximately 2 pounds.

[2] These data were compiled in March 1952.

Heavy tractors are a "must" for the deep plowing necessary to control Kans grass[3], which has gradually taken over vast areas of India's fertile land. India's Central Tractor Organization maintains a fleet of crawlers for this purpose, and State governments are making loans to cultivators to finance the work. Deep plowing about every 3 years is also a profitable practice on the cotton lands of Central and South India. This has been done for years by use of teams of 6, 8, or even 10 bullocks, but tractors are playing an increasingly important role.

Heavy machinery is being used to bring idle land into cultivation, as in Punjab, where the State has large holdings. The plan is to operate State farms with mechanical equipment for about 3 years, then to distribute the land to private operators, as the State-owned machinery moves on to open up more land that had been previously uncultivated.

All told, the State governments of India own probably 2,000 tractors, varying from about a dozen in Jammu and Kashmir to more than 500 in Uttar Pradesh.

Mechanization of India's agriculture has been hampered by a lack of people trained to operate and maintain farm machinery. Consequently, costs have often been rather high, expensive machines have lain idle for lack of repairs, and excessive wear has resulted from lack of care. Even more difficult than finding people to operate and service heavy equipment has been the task of finding those skilled in adjustment of relatively simple tools like plows, grain drills, and mowers.

These problems, however, are receiving the earnest attention of the Central Tractor Organization and the Directors of Agriculture in the Indian States. Training programs at every level are giving

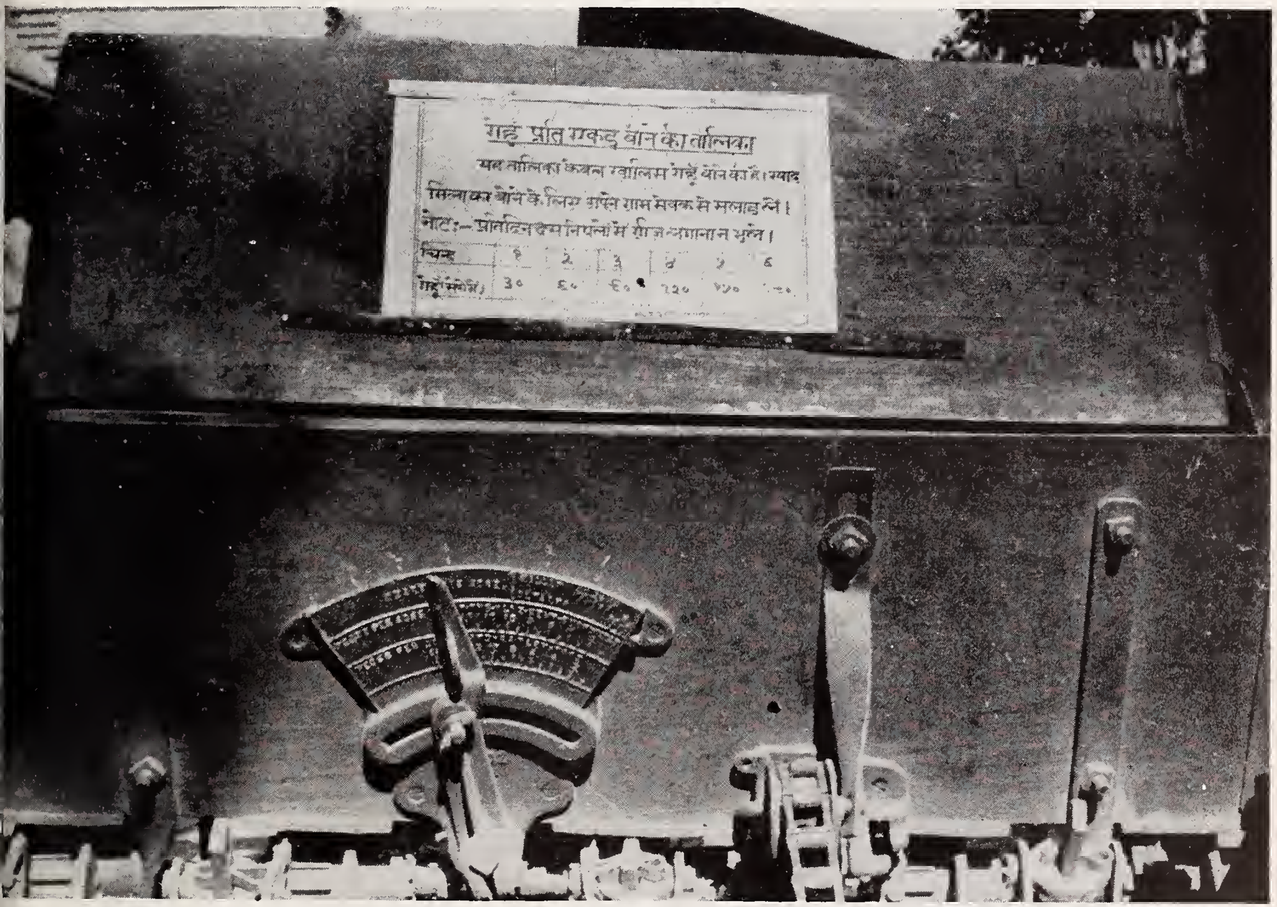

Chart with settings in Hindi fastened to the inside of the seed-box top on this United States grain drill makes it possible for the Indian farmer to adjust his machine. Such simple changes greatly increase efficiency and production on India's farms.

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[3] *See* "India Fights a Land Invader," by F. L. Timmons, *Foreign Agriculture,* May 1952.

increased emphasis to these matters. The farm machinery distributors are conscious of the need for better-trained men to operate, maintain, and repair equipment, and several of the companies have organized their own training schools.

With the cooperation of machinery, petroleum, and tire distributors and manufacturers, the Central and State governments are holding schools to train agricultural engineers, operators, foremen, and supervisors.

A motion picture "India Plows Deeper" was produced for the Technical Cooperation Administration and accepted by the Government of India as a documentary film for general distribution to regular movie theaters. Like the training schools themselves, the film hammers at the theme that machinery itself will not "do a job" unless there are a sufficient number of people skilled in the use and care of mechanical equipment.

The Indian Institute of Technology at Karagpur, some 70 miles west of Calcutta, now includes in its curriculum a 4-year degree course in agricultural engineering. The school plans to take about 50 new students into this course each year, giving special emphasis to soil and water conservation, and to farm machinery, including power, animal-drawn, and hand-operated equipment. Until now the Allabahad Agricultural Institute, a foreign mission school, has been the only school offering a degree in agricultural engineering.

Thus, farm machinery, together with other improved agricultural methods, better health and sanitation, and education, is doing its part to bring more food and a better life to India's 361 million people.

Indian farmer hitches his team of bullocks to an iron-pointed wooden plow. Plows like this one, though improvements over the all-wood plows used in India for centuries, are gradually being replaced by metal plows.

Soviet Genetics

The Soviet doctrine of genetics is seriously affecting agricultural research in the Soviet Union and in the satellites. For that reason a brief review of the doctrine may be of interest to readers of this magazine.

by ROBERT C. COOK

Since 1948 the world has seen the development in the Communist countries of a new kind of science. This science emerged as an "official science" in the Soviet Union at a Genetics Conference in Moscow held in August 1948. Even the place of its proclamation—the Lenin Academy of Agricultural Science, which is the agency coordinating all agricultural research in the Soviet Union—indicated how closely the new science was to be related to agricultural research.

The "hero" of the Moscow convention was a Soviet agronomist, Trofim D. Lysenko, who succeeded in undermining the great influence of the famous Russian botanist and leader in agricultural research, Dr. Nicolai I. Vavilov, who was reportedly liquidated by the Soviets. As early as 1932, Lysenko discovered—or rather rediscovered for the second time—the phenomenon he called yarovization. This word might be translated springizing or vernalization, for it means that by appropriate treatment winter wheat can be turned into spring wheat. The process is simple. The winter wheat seeds are moistened and kept warm until germination starts. The germinating seeds are then kept at a temperature near freezing for some weeks. When the seeds are planted after this treatment they behave as spring wheat and produce a crop the same year[1]. (Ordinarily when winter wheat is sown in the spring, it does not produce a crop until the following year.)

Lysenko claimed that yarovization altered the heredity constitution of the wheat, a contention lacking scientific proof. He alleged furthermore that his discovery demolished the basic premise of genetics that the hereditary constitution of organisms is unaffected by ordinary changes in the environment. However, geneticists have long known that certain environmental stimuli, like X-rays and exposure to a few potent chemicals, will change the hereditary structure of organisms. Cosmic rays, to which our bodies are constantly exposed, do induce heredity changes. But the ordinary incidents of existence—even situations of stress—do not affect heredity[2].

Lysenko based his ideas of environmental modification of heredity on the observations and doctrines of a Russian Burbank named Ivan Michurin, a plantsman with a green thumb and a gift of pontification. Michurin claimed to be able to change the heredity of plants by "shaking" their heredity through exposing them to unfavorable or unusual environmental conditions and by "mentoring" the heredity of one kind of plant by grafting it onto another kind of plant.

The Lysenko-Michurin ideas of heredity fitted well with the views of the leaders of the Communist Party, who were committed to the proposition that all men are created the victims and the creatures of the environment in which they are reared. Plagued by the low production of Russian agriculture, party leaders in the Kremlin were attracted by Lysenko's glowing promises of bumper crops via yarovization (of animals as well as of plants). Formal genetics, despite much valuable research during the early Soviet period, could hold out no such glowing prospects.

During the war years, Lysenko strengthened his hold on genetics in the U.S.S.R. And by 1948, the stage had been set and the curtain went up on the founding of a "science" by autocratic fiat, at the meeting of the All-Union Lenin Academy of Agricultural Science held in Moscow, the first week of August. Alleged to be a bonafide scientific gathering, it turned out to be an inquisition—those on trial were the few in Russian science who still held out

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[1] This method received extensive trial in many countries, including the United States, and was found to have no practical application.

[2] For details of the Lysenko controversy, see *Journal of Heredity*, July 1949; "Heredity, East and West;" by Julian Huxley, Schuman, New York, 1949; "The Death of Science in Russia," by Conway Zirkle, University of Pennsylvania Press, 1949.

for the "bourgeois-capitalist" ideas that in science the facts are an essential basis for an understanding of nature. One of the respected biologists of pre-Communist Russia, Professor B. M. Zavadovsky, a sick old man en route from one hospital to another, expressed his "profound disagreement with T. D. Lysenko." "I think, Comrades, that we are making a serious mistake and are misleading authoritative bodies by insisting that only two lines, two trends, exist in Soviet-biology: the doctrines of Lysenko, called the Michurin trend, and that of the formal-genetic Weismannist trend, while all who think otherwise and are bold enough to disagree with Lysenko are allocated wholesale by Lysenko's adherents to the odious category of 'formal geneticists.' "

Lysenko's answer came on the last day of the meeting. Before summing up, Lysenko made this statement: "The question is asked in one of the notes handed me, 'What is the attitude of the Central Committee of the Communist Party to my report?' I answer, The Central Committee of the Communist Party examined and approved my report."

This was the first time in the twentieth century that the content and concept of any science had been decided, not by experiment and by vigorous formulation of the hypotheses, but by the arbitrary decision of a purely political governmental agency.

Lysenko went on to take up "some of the points brought out in our session." The chromosome theory of genetics is traced to Weismann; therefore all connections of chromosomes with heredity were labeled "Weismannian" and disposed of. The Michurinian trend "is a materialist trend, because it does not separate heredity from the living body and conditions of its life." Therefore, by some alogical about-face, Michurinism is enthroned as the doctrine of authority and Morganism-Mendelism made the doctrine of heresy. Vegetative hybridization was again detailed and the labile nature of organisms reaffirmed, "for heredity is determined by the specific type of metabolism. You need not change the type of metabolism in a living body to bring about a change in heredity."

In the closing pages of his statement Lysenko propounds a principle that has since become a theme song of Marxist science. "For instance, the Weismannist conception that the hereditary characteristics of an organism are independent of environmental conditions has led scientists to affirm that the property of heredity (i.e., the specific nature of an organism) is subject only to chance. All the so-called laws of Mendelism-Morganism are based entirely on the idea of chance. . . .

"In general, living nature appears to the Morganists as a medley of fortuitous, isolated phenomena, without any necessary connections, and subject to no laws; chance reigns supreme. . . .

"A science which fails to give practical workers a clear perspective, the power of finding their bearings, and confidence that they can achieve practical aims does not deserve to be called science.

"Physics and chemistry have been rid of fortuities. That is why they have become exact sciences.

"By ridding our science of Mendelism-Morganism-Weismannism we will expel fortuities from biological science.

"We must firmly remember that science is the enemy of chance."

Following the announcement that Lysenko had the official approval of the Kremlin, the few geneticists in Russia who attempted to maintain an open mind regarding capitalistic "Mendelist-Morganist" genetics recanted their views, either at the close of this historic meeting or in letters to the newspaper *Pravda*. Since that time experimental procedures in genetics in the sense that this term is used in the non-Communist world has virtually ceased to be a part of Marxian genetics. Lysenko has banned mathematical and statistical procedure in genetical science and has interdicted the use of controls in experiments. Discussions of genetics in the Soviet Press and in the reports are concerned more with party orthodoxy than they are with the facts.

Ever since Lysenko became prominent, there have been promises that citrus fruits would soon be growing in the environs of Moscow. As late as 2 years ago, Hero of Labor S. M. Grinko was awarded a Stalin Prize for growing lemons in Siberia. They were grown in a greenhouse during most of the year and transplanted outdoors during the brief summer. Eric Ashby, in his important book, "A Scientist in Russia," tells of potato farming in the environs of Murmansk, in Russia's far northwest. There, year after year, some 40 tons of fertilizer per acre were transported hundreds of miles to produce 14 tons of potatoes. When Ashby asked why not haul in the potatoes from a more productive area and save all this futile effort, he was informed that this "would not be wresting food from the Arctic." This idea that nature and reality can be bludgeoned by the Commissars is carried to great lengths in the Soviet Union, but the promised abundance, like most Soviet promises, just has not materialized.

The drive to continue to extend the control of life processes by Soviet biologists has extended far beyond the area of formal genetics. In 1950 there was a great stir in the Soviet Union over the "revolutionary" discoveries of the biologist, Professor Olga Lepeshinskaya. For many years, Lepeshinskaya has been claiming that cells arise *de novo* as well as from pre-existing cells. She believes that she has observed cells arising in the yolk globules of the hen's egg. This idea of "spontaneous generation" was current throughout the Middle Ages. It has been abandoned since Theodor Schwann and Matthias Jakob Schleiden propounded and generalized the cell theory more than a century ago and Louis Pasteur by exact experiments gave the death blow. Observers in the Western World have not been able to confirm Professor Lepeshinskaya's observations. But, like Lysenko's theories, they fit into the dialectical pattern of the Communist High Command.

In order to keep a cult like Michurin-Lysenkoism in the public eye, new discoveries are essential. They have not been lacking if the Soviet press—lay and scientific—is to be believed. In 1950, Lysenko was awarded a Stalin Prize for turning wheat into rye. To Western biologists, this claim is incredible. The chromosome constitution of the two distinct genera to which these crops belong is quite different. Hybrids between wheat and rye are possible, but they are almost always sterile unless fertility is induced by treatment with colchicine to double the number of chromosomes and make possible an orderly chromosome division in the formation of pollen and egg cells prior to fertilization. But Lysenko claims that merely by exposing wheat to an unfavorable environment the internal chromosome constitution of the wheat cells are reorganized to make rye cells.

Such result could appear to come about if a mixed stand of rye and wheat were planted under conditions more favorable to the rye than to the wheat. Since both rye and wheat are self-fertilized, the better adapted rye would yield more seeds than the struggling wheat. Eventually therefore the population would be predominantly rye. The "changing" of wheat into rye in this way would be a study in differential reproduction, not in genetics. Such beliefs find their counterpart in the folklore that wheat can turn into chess.

The simple explanation has been denied by the Marxist biologists. Now Soviet workers are finding grains of one kind of cereal in the heads of other species—or genera—of cereals. "Individual grains of soft wheat were quite easily observed in the spikes of durum wheat, i.e., grains of one botanical species were found in the spikes of another species." These are the words of V. K. Karapetian published in 1948. The following year a great many queer combinations were reported: More than 200 grains of rye were found in heads of wheat; cultivated oats *(Avena sativa)* yielded grains of wild oats *(A. fatua)*, a very different plant, etc.

These claims are incredible in the context of biological science. Species sometimes show variability in their progeny, but these variants definitely are not plants of different species, let alone of different genera. Examples of these startling phenomena, so widely acclaimed in the Soviet literature, have never been presented to the scrutiny of Western scientists.

There have been many extensions of academician Lysenko's dictum that "science is the enemy of chance." For example, the official statistical institute in Moscow has recently taken the position that chance has no place in statistics. Yet every student of statistics knows that the very basis of statistical science is probability.

The views of Trofim Lysenko, and the cult of Marxist science, are spreading like a miasma across the world. Because the Marxist cultists offer quick and easy solutions to difficult problems in agronomy and agriculture, in economics and history, their notions have a strong appeal to those who shrink from the stern discipline of looking straight at the beauty, mystery, and complexity of the universe and life.

Magic has always failed man as a safe guide. In the U.S.S.R. this ever-repeated and painful lesson of history is again being demonstrated.

List of further reading:

"The Situation in Biological Science." Translation, as prepared in U.S.S.R. of stenographic report of Proceedings of Lenin Academy of Agricultural Science of U.S.S.R., July 31-Aug. 7, 1948. International Publishers, New York 1949.

"Genetics in the Soviet Union," by Eric Ashby. *Nature* Dec. 11, 1948, pp. 912-913. Macmillan and Co., Ltd., London.

"Lysenko's Latest Discovery—The Conversion of Wheat into Rye, Barley and Oats," by P. Maheshwari. *Nature* July 12, 1952. Macmillan and Co., Ltd., London.

"A Survey of Soviet Russian Agriculture," by Lazar Volin. U. S. Dept. Agr. Monograph 5, pp. 97-101, 1951.

"County Agent" in El Salvador

By W. E. HARVEY

If one of the early pioneers in county agent work in the United States could sit down and chat with Jaime Chacón of El Salvador, he would be carried back 30 to 40 years to his own experiences when a small group of earnest men were literally blazing the trail that was to carry the fruits of agricultural science to the people on the land.

Twenty-three-year-old Jaime, a veteran of barely 2 years as delegado (a county agent in El Salvador) of La Paz Department, faces many problems strikingly similar to those of his northern predecessors a generation ago, who, according to a report written about 1905, "traveled on horseback, usually leaving home on Monday morning and returning about the end of the week. . . . His complete equipment consisted largely of a horse, a saddle, a note book, and a bunch of circulars." This description just about fits Jaime Chacón, except that he must rent a horse to use with his government-owned saddle whenever his business takes him beyond walking distances from the few surfaced roads, and that his bunch of circulars are of limited value in a land where many farmers cannot read.

El Salvador, smallest and most densely populated of the Central American Republics, is almost entirely agricultural. Some Salvadoran farms are large and operated with modern machinery, but most of them are small and still tilled in a manner similar to that used when the Spaniards arrived 400 years ago. Coffee is the most valuable cash crop, but the bulk of the small farms grow corn, beans, rice, and other food crops on a subsistence basis.

Agricultural science in El Salvador was given impetus in 1942, when the governments of El Salvador and the United States signed an agreement for technical collaboration, aimed largely at increasing production of export commodities vital to the wartime needs of the United States. Experimental work was begun by the Centro Nacional de Agronomía, the research branch of the Salvadoran Ministry of Agriculture, and a body of research information began to accumulate.

With the end of the war, emphasis shifted to promoting the over-all agricultural economy of the country, and though the Centro continued to acquire useful knowledge, there was no practical means of making it readily available to the farmer—exactly the same problem that plagued United States agriculture a half a century before.

The problem is being met in the same way—by agricultural extension carried out through actual on-the-farm demonstrations under the direction of trained men whose roots are still firmly in the soil. In 1947 El Salvador set up its Extension Department, with the assistance of United States technicians. The past 5 years have seen substantial progress, and now delegados are at work in all of the Republic's 14 Departments.

The Department of La Paz, Jaime Chacón's domain, is approximately 25 miles square, about the size of a typical Midwestern county. Its 15,000-odd rural families live, for the most part, on farms of less than 10 acres and grow coffee, corn, beans, citrus crops, and cotton. Much of the land is extremely hilly, with a consequent erosion problem.

Like most of his fellow delegados, Jaime received his agricultural education at the Escuela Agrícola Panamericana operated by the United Fruit Company in Honduras, for there is yet no college of agriculture in El Salvador. Following his completion of the 3-year course, he returned to his native land to work for a while as sales-serviceman for a large commercial farm supply firm, which brought him into contact with many farmers and made him acutely aware of their problems.

When he decided to go into extension work, he was given several weeks of intensive preservice training in both subject matter and extension methods at the Centro and spent a short time with a delegado already in the field. Then, in January 1951, he opened up his office as a full-fledged delegado.

Unlike many of the early United States county agents, he does have an office—a 14 by 14- foot room provided by the local mayor. He is assisted by a 25-year-old male secretary, who provides his own typewriter and takes care of visitors when the delegado is in the field. Jaime hopes in time to acquire a filing cabinet and a telephone.

Although real agricultural extension work has been in progress in La Paz for only about 2 years,

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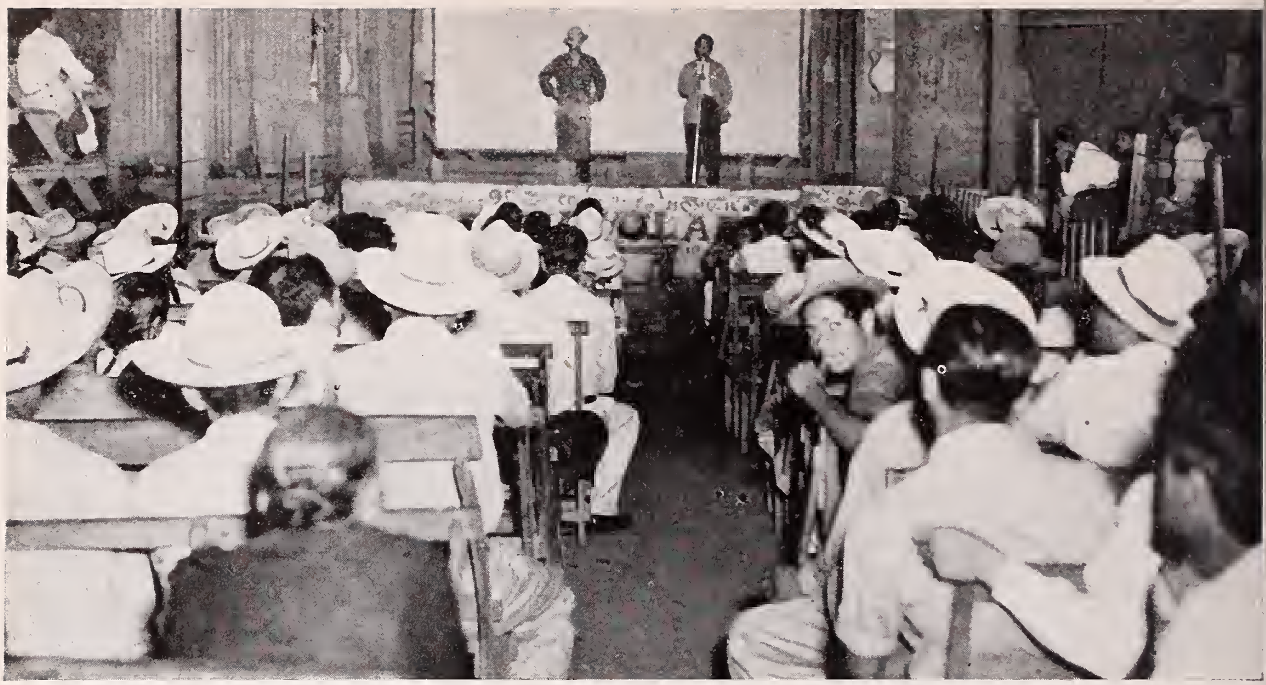
Chacón feels that it is making itself felt. He has high praise for the cooperative attitude of farmers, especially the medium-sized ones. Although they may not have had complete confidence in him in the beginning, most of them were perfectly willing to give him a chance to prove himself. This has meant that he has had to be very careful to avoid mistakes and failures.

The major portion of the La Paz extension program is built around 17 result-and-method demonstrations. Many of them he visits several times a year. He says, "I know that a lot of people are watching these and the way they turn out will have a lot to do with the acceptance of extension. So I try to set these demonstrations up with care, get all the help I can from El Centro, and follow-up on them closely." These demonstrations include projects in poultry house construction and flock management, soil conservation practices, citrus orchards, and sugarcane and sorghum variety demonstrations.

"County agent" Jaime Chacón stops to talk with the farmers of his area, who are on their way home from harvesting their crop of beans.



Farmers of La Paz, El Salvador, eager to learn new ways, attend a meeting held by their "county agent."

In addition to the farm demonstrations, delegado Chacón is using the time-honored extension techniques of general meetings, farm visits, and bulletins and publications. Nearly all farmers are eager to get bulletins and the monthly extension newspaper published by the Centro, but the effectiveness of reading matter is limited by the inability of many to read well enough to understand. "I'm sure of one thing," Chacón says, "and that is the necessity of teaching more by showing." He finds all sorts of visual aids valuable, particularly movies, but quickly adds that "movies made in the United States as are most of them I've been able to get, always draw a big crowd, but the people say 'That's fine for the U. S. but we can't do it here.' I hope we can get some local movies soon, as it would help my work more than any one thing."

The seeds, eggs, and insecticides that the Ministry of Agriculture and the research departments of the Centro have given him for distribution have been the means of reaching many farmers and showing how extension services can be helpful to them.

Pioneering extension work in an area where no farmers' organizations of any kind existed has obliged delegado Chacón to begin by working with individual farmers, but he is developing the group approach as rapidly as possible. Late in 1951 a thousand people, attending a meeting that he had arranged, eagerly accepted the idea of organizing a club to further extension work in the community. Chacón hopes ultimately to have a federation of such clubs to form the backbone of his extension organization.

Working with young people also figures prominently in Jaime's plans. His appointment as technical advisor for the local school garden committee provided a valuable contact that enables him to use the schools as an informational medium. In his trips about the Department, he makes it a practice to visit the principal of each school, and usually addresses the pupils, losing no opportunity to implant ideas and enthusiasms to be taken home to parents. He plans, under the guidance of trained personnel from the Centro, to establish a youth program patterned after 4-H work.

Chacón points to the three major agricultural problems that demand attention in his area: soil erosion and soil depletion; lack of irrigation systems; and poor nutrition and sanitation, especially among the small farmers. The Departmental extension program at the present time is directed almost solely toward an immediate increase in farm production, but Chacón hopes that in time his extension program can be broadened so as to effectively attack all phases of these three major problems of his area.

Quick-Frozen Food In the United Kingdom

By WILLIAM KLING

Frozen foods are not so high on the shopping list of housewives in the United Kingdom as they are in the United States and some other countries. Most British housewives buy frozen foods only by straining their budgets and only if they can use the food immediately.

Sales of frozen foods are, for the most part, confined to Britain's larger urban centers. Shortages of storage cabinets and, especially, the high cost of them are important deterrents to expansion. Equally important is the relatively lower income of working people. The British worker earns about $20 a week; a 12-ounce package of green peas costs about 24c, nearly the same as in the United States, where the average wage is probably about three times $20. Moreover, few British workers have electric refrigerators in their homes, let alone deep-freeze cabinets.

As a result, most of the frozen foods used in the United Kingdom are bought by people with high incomes and by restaurants.

A wide variety of frozen fruits and vegetables are available to those who can buy them. Because of meat rationing, little frozen fresh meat is to be found but some precooked frozen meats, most of them imported, are sold, as well as a moderate quantity of domestically produced poultry. A great deal of frozen fish is imported and sold in bulk by the ordinary fishmonger. Frozen fish in a consumer-sized package is not widely available but is growing in popularity.

TABLE 1.—*Production of quick-frozen vegetables in the United Kingdom, 1951*

Vegetable	Production (net weight)
	Long tons
Broad beans	24
Green beans	665
Brussel sprouts	135
Cabbage	65
Cauliflower and broccoli	115
Peas	5,282
Other (spinach, carrots, asparagus, etc.)	220
Total	6,506

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The first quick-freezing plant in Britain was opened in 1934 and the outlook for the industry seemed bright until the war broke out and operations had to be suspended. Now, there are 30 or 40 processors in the United Kingdom but only half a dozen have an output of any great significance and only 3 or 4 distribute their products nationally.

The production of quick-frozen fruit in the United Kingdom rose from 1,434 tons in 1950 to 2,196 tons in 1951. The output of vegetables dropped from 7,616 tons in 1950 to 7,287 tons in 1951. Four-fifths of the quick-frozen vegetable production consisted of peas.

To supplement domestic production, relatively large quantities of frozen foods, especially of fruits and vegetables, have been imported, but recent import restrictions will reduce further shipments. Frozen foods have been coming from several European countries — notably, from the Netherlands, Belgium, and France. In the first 10 months of 1952, 1,545 tons of frozen vegetables were imported into the United Kingdom and during 1951 1,447 tons were shipped in, compared with 1,043 tons in 1950. Import data are not available for fruit, but moderate quantities, including pineapples, apricots, and peaches, were brought in.

Production and consumption of frozen foods in the United Kingdom will probably continue to expand. That expansion will not be rapid, however, for it is unlikely that more equipment will be installed on a large scale or that frozen fruits and vegetables will get a higher priority on the shopping lists of the British in the next few years.

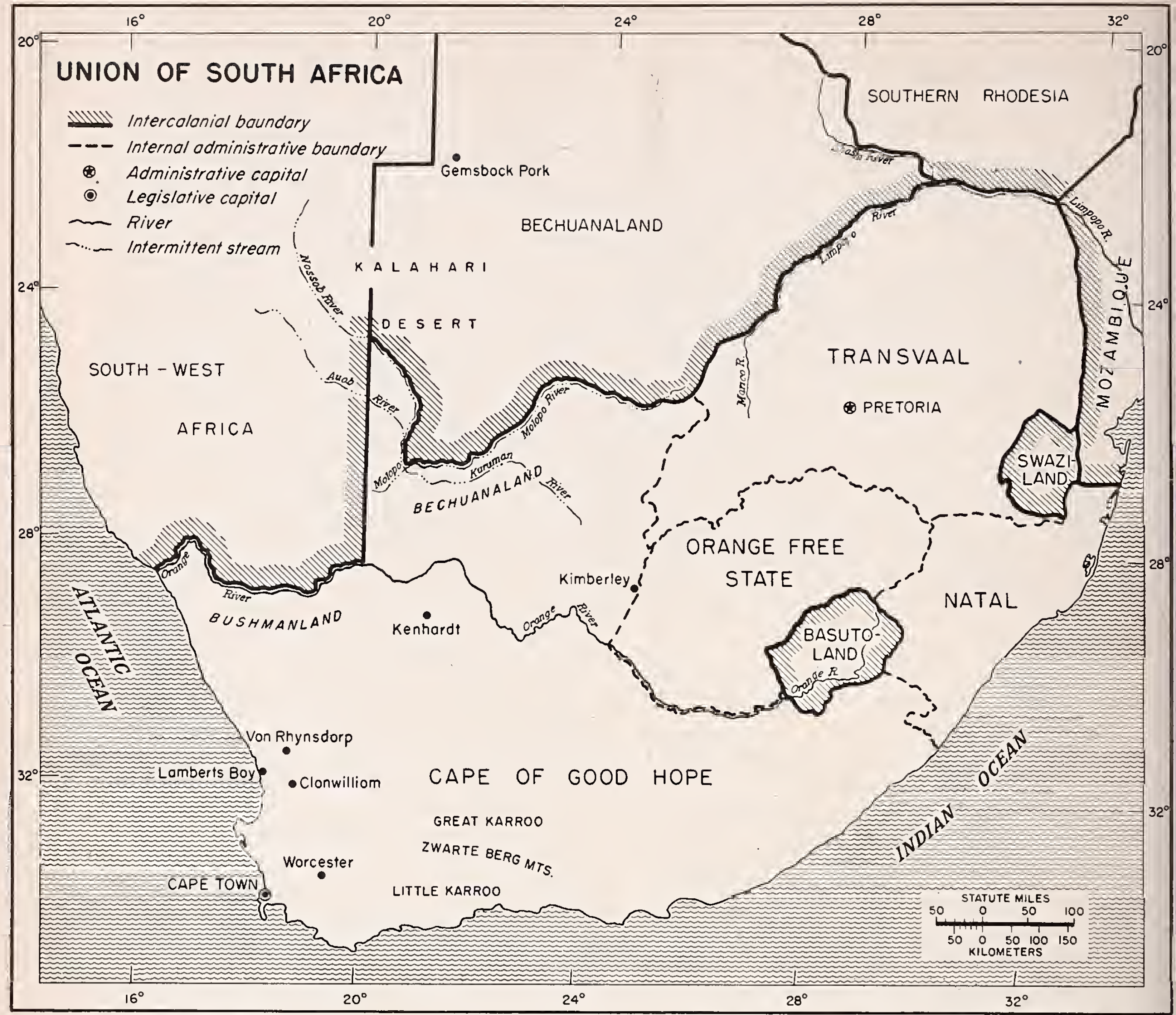
TABLE 2.—*Production of quick-frozen fruit in the United Kingdom, 1951*

Fruit	Production (net weight including sugar/syrup)	Average percent of sugar used (by weight, of output)
	Long tons	*Percent*
Apples and apple puree	241	17
Blackberries	41	21
Black currants and black currant puree.	108	22
Cherries	17	18
Gooseberries	61	21
Plums (damsons, greengages, etc.)	101	12
Raspberries, raspberry puree, and loganberries.	293	20
Strawberries and strawberry puree	813	25
Fruit salad and mixed fruits	86	19
Other (peaches, bilberries, rhubarb, etc.)	200	(1)
Total	[2]1,961	

Source: Ministry of Food Bulletin, Sept. 6, 1952.

[1] Various.

[2] Of which 69 tons were packed without sugar.



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